SCIENTIFIC PAPER

Laparoscopic Incisional Hernia Repair With Fibrin Glue in Select Patients

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ABSTRACT

Background and Objective: Laparoscopic treatment of incisional hernias can be performed using different types of fixation devices and prosthesis. We present a case series of 19 patients with incisional hernias with a diameter of <6cm, who underwent laparoscopic repair using Hi-tex dual-side mesh, positioned intraperitoneally, fixed to the abdominal wall by fibrin glue (Tissucol).

Methods: Nineteen patients with incisional hernias <6cm in diameter were enrolled in this study and treated laparoscopically with Hi-tex and Tissucol. Surgical complications and patient outcomes were assessed with a clinical follow-up.

Results: Laparoscopic repair of incisional hernias by using Hi-tex mesh affixed to the parietal wall with fibrin glue was feasible and easy in patients with parietal defects <6cm in diameter. Mean operating time was 30 minutes. Mean hospital stay was 1.5 days. Almost no postoperative pain, major surgical complications, seroma formation, relapses, or prosthesis infection occurred during a mean follow-up of 20 months.

Conclusions: In select patients, Hi-tex mesh affixed using fibrin glue allows laparoscopic repair of incisional hernias with very good patient outcomes, especially in terms of postoperative pain and seroma formation.

Key Words: Composite mesh, Incisional hernia, Laparoscopy, Fibrin glue.

INTRODUCTION

An incisional hernia develops in 3% to 29% of laparotomy incisions, with an increasing incidence in patients who develop wound infection or other forms of wound complications.[1] Laparoscopic repair has become increasingly popular among surgeons and patients following the development of minimally invasive techniques.[2] Several authors have shown the advantages of this technique in terms of lower recurrence rates, length of hospital stay, postoperative pain, and decreased complication rates.[2-12] Contraindications to laparoscopic repair are the classic contraindications to laparoscopic surgery plus the presence of big incisional hernias with loss of domain.

Data coming from numerous centers confirm that tensionless repair reduces the complication rates and the frequency of recurrences.[13] For the repair to be tensionless, the placement of a prosthesis to cover the defect is necessary. Different types of mesh can be used. They are usually fixed to the peritoneum with staples. In some patients, persistent pain and other discomfort, such as intestinal subocclusion or occlusion, caused by adherence formation around the staples are unpleasant complications.[13] New fixation techniques are still being studied. Some authors have described the use of fibrin glue to fix the prosthesis to the parietal wall, eliminating postoperative pain due to peritoneal stretching and nerve compression.[14-18] In this study, we present a case series of 19 patients with incisional hernias (diameter <6cm) who underwent laparoscopic repair using Hi-tex dual mesh fixed to the parietal wall with fibrin glue (Tissucol, Baxter Healthcare, Deerfield, IL).

MATERIALS AND METHODS

Prosthetic Material

Hi-tex (dual-sided composite mesh, Textile Hi-tec, France) is a 1.5-mm thick 3D "honey comb" macro-perforated structure consisting of a permeable peritoneal side of polyester for good fibroblast colonization and rapid tissue fixation and a nonabsorbable and nonadherent smooth side of polyurethane allowing fluid transfer and contact with viscera. It is 100% artificial material with no

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viral contamination risk. It has an excellent multidirectional elasticity. Before using Hi-tex on humans, an experimental study to evaluate the biocompatibility and tissular ingrowth was performed on a pig, in collaboration with the Veterinary Clinic of the University of Milan. The experimental protocols were approved by the appropriate institutional review committee and meet the guidelines of the responsible governmental agency. With the pig under general anesthesia, the mesh was attached to the peritoneum with either staples or fibrin glue. A second look after 3 weeks was than performed to check the degradation of the prosthesis, the inflammatory response, and the tissular ingrowth.

Mechanism of Fixation

Tissucol (Baxter Healthcare, Deerfield, IL) is made up of 4 components in 2 solutions, one containing high concentrations of fibrinogen and aprotinin and the other containing thrombin and calcium chloride. The 2 solutions are contained in separate syringes that join and mix in a catheter (Duplotip, Baxter BioSurgery, Deerfield, IL) to be applied together. The 2 components mix onto the lesion in a clear and viscous compound, which adheres stably to the lesion itself and turns white and gummy in a few seconds. The strength of the adhesion increases with time and reaches 70% of maximum efficacy in 10 minutes.[19] Tissucol mimics the last step of coagulation and is an adjuvant to hemostasis. In addition to its hemostatic action, Tissucol has been shown to have adhesive properties,[20] and to promote wound healing[21] and fibroblast proliferation.[22] In our series, we used 2-mL Tissucol for prostheses up to 12cm, 3mL for prostheses up to 15cm or 10cm × 15cm, and 5mL for prostheses up to 20cm × 15cm. Thrombin was diluted with sterile water from 500 to 50IU/mL to slow polymerization to 3 minutes to allow adequate time to fix the prosthesis securely.[16]

Patient Characteristics

Patients with an incisional hernia <6cm in diameter, who met eligibility criteria for surgical procedures, were enrolled in this study. The inclusion criteria were performance status according to a Karnofsky score of 80% to 100%, indication and eligibility for a surgical procedure with curative intent, and clinically confirmed incisional hernia. Exclusion criteria were cardiopulmonary disorders, portal hypertension, contraindications to laparoscopic procedures, and an American Society of Anesthesiologists (ASA) score = 5. The Research Ethics Board approved the study before it began, and written informed consent was obtained from each patient.

Surgical Preparation

Intestinal preparation was accomplished by bowel washout with Selg (Esse, Promefarm srl Milan Italy) and Mylicon (Warner Lambert Consumer Healthcare, Milan, Italy) to reduce gas content. A first-generation cephalosporin was given as prophylaxis. Both open and laparoscopic procedures were performed with the patients under general anesthesia. A catheter was inserted into the bladder to remove urine and decompress it. If the hernia was near the stomach, a gastric (nose to stomach) tube was inserted to decompress it.

Surgical Technique

Pneumoperitoneum was established with a Veress needle, usually placed as far distally as possible from the previous incision. The 3-trocar (Ethicon EndoSurgery, Somerville, NJ, USA) technique were usually used. A security test with a water-filled syringe was made before insertion of the first 10-mm to 12-mm trocar as far laterally as possible from the hernia. A 30-degree laparoscope (Storz, Tuttlingen, Germany) was used to provide the best view of the inner face of the anterior abdominal wall. Two additional trocars (5mm and 12mm) were placed in the same side of the abdomen, forming a triangle. Adhesiolysis was performed with a 5-mm ultrasonic scalpel (Ultracision, Ethicon EndoSurgery, Somerville, NJ, USA) that could also be used as a scissors (with open blade) in case of severe adhesions. Alternatively, monopolar or bipolar scissors were used, especially for loose adhesions. The entire bowel was detached from the wall to expose the weakened area. No attempt was made to reduce or resect the peritoneal sac. The mesh chosen (Hi-tex dual-side composite mesh, Textile Hi-tec, France) was rolled and introduced via the 10-mm to 12-mm trocar, than applied over the hernia to overlap the weakened area by 4cm to 5cm in all directions. The mesh was fixed by using fibrin glue. No drainage was used. Patients were allowed to eat a soft diet on the first postoperative day, and they were usually discharged on the second postoperative day.

Clinical Outcome

The clinical outcome was determined by a follow-up evaluation that consisted of a physical examination to determine possible relapses or seromas. Clinical assessments were made at the first, third, and sixth months after surgery and every year thereafter. After the first year, the patient was told to contact us if he or she felt any problem. The follow-up included assessments for pain and postoperative complications.

RESULTS

Good Biocompatibility of Hi-tex

An experimental study using a pig showed the good biocompatibility of Hi-tex mesh and the feasibility of fixing it to the parietal wall by using fibrin glue. On a second look made 3 weeks after the prosthesis was fixed, we noted good tissular ingrowth, associated with isles of new peritoneum and neovascularization **(Figure 1)**, without any sign of prosthesis' degradation. A part of the prosthesis was then removed and analyzed microscopically. A low inflammatory reaction and good fibroblast colonization were observed **(Figure 2)**.

Patient Characteristics

Nineteen patients (11 men, 8 women; mean age 53 years) were eligible and provided consent to participate in the study. All the patients had a parietal defect <6cm in diameter, and they all underwent laparoscopic repair with Hi-tex dual-side composite mesh. According to the size of the parietal defect, we used two 20cm x 15cm mesh, 5 meshes 15cm in diameter, and 12 meshes 12cm in diameter **(Table 1)**. The mesh had to overlap the defect by at least 4cm in each direction. In 17 cases (when 15cm and 12cm meshes were used), we were able to fix the mesh without using transparietal stitches, thanks to the high multidirectional elasticity of Hi-tex **(Table 1)**.

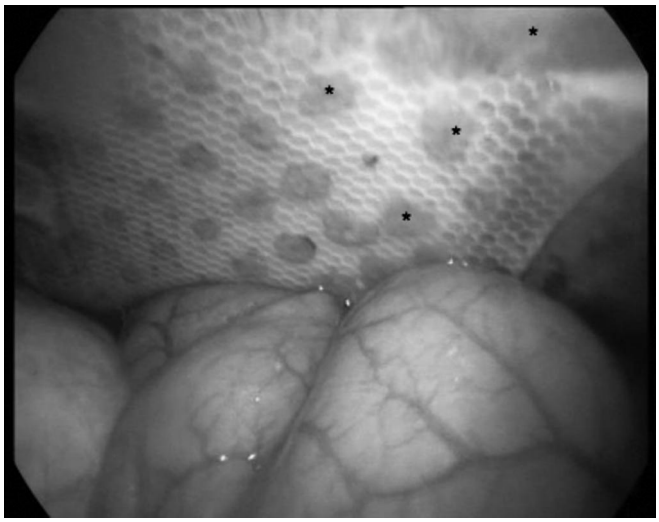

Figure 1. Hi-tex mesh fixed to a pig's parietal peritoneum with Tissucol. After 3 weeks, we noted no signs of prosthesis' degradation, a good biocompatibility, and tissular ingrowth associated with isles of new peritoneum (*).

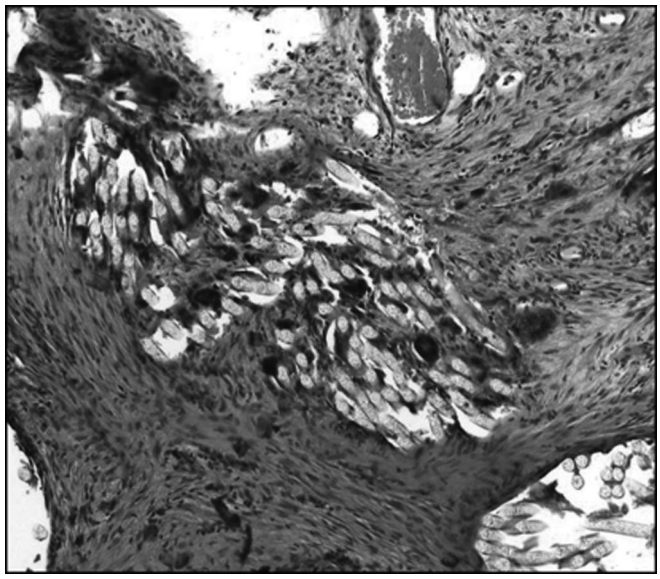

Figure 2. Microscopic analysis of a part of Hi-tex mesh removed 3 weeks after its fixation to the pig's parietal peritoneum with Tissucol. We noted a low inflammatory reaction and good fibroblast colonization.

Table 1.
Mesh Size Versus Defect Size

Mesh Size	Total	Defect Size	Transabdominal Stitches
20 cm x 15 cm	2	6 cm (2)	2
15 cm round	5	6 cm (2); 5 cm (3)	0
12 cm round	12	4 cm (6); 3 cm (3); 2 cm (1); 1 cm (2)	0
Total	**19**	**19**	**2**

Laparoscopic Repair of Incisional Hernia Using Hi-tex Was Safe Without Major Complications

With a mean follow-up of 20 months (range, 2 to 30), no significant major postoperative complications were observed: no intestinal occlusion or subocclusion, prosthesis infection and/or migration, and no incisional hernia relapse occurred **(Table 2)**. No intraoperative complications occurred either. The intervention was safe and fast, with a mean operative time of 30 minutes without significant immediate postoperative complications. No seromas were observed **(Table 2)**. The mean hospital stay was 1.5 days (range, 1 to 2). All patients reported very low postoperative pain **(Figure 3)**. Mean pain score was ranked according to the Visual Analogue Scale (0=no pain to 10=worst pain). We asked patients to rank their pain in

Table 2.
Operative Findings

Mean Operative Time (min)	30 (range, 25 to 35)
Mean Hospital Stay (days)	1.5 (range, 1 to 2)
Surgical Complications	None
Prosthesis Infection	None
Seroma Formation	None
Relapses	None

the first postoperative hours and after 7, 15, 30, 60, and 90 days from the laparoscopic repair.

DISCUSSION

Several authors[2-12] have reported on the advantages of the laparoscopic technique for incisional hernia repair, in terms of lower recurrence rates, shorter hospital stay, lower postoperative pain, and decreased complication rates. The higher complication rate in the open-anterior incisional hernia repair technique seems to be associated with extensive lateral dissection and subcutaneous drainage placement, which increase the rate of infection.[4] Infection is one of the major conditions that allows incisional hernia relapse.[23-26] Mesh is usually fixed to the peritoneum by staples. In some patients, persistent pain and other discomforts, such as intestinal subocclusion or occlusion, caused by adherence formation around the staples, are unpleasant complications.[13] Some authors[4-18] have described the use of fibrin glue to fix the prosthesis to the parietal wall, eliminating postoperative pain, due to peritoneal stretching and nerve compression. In this article, we propose a case series of 19 patients with incisional hernias (diameter <6cm) treated laparoscopically, using Hi-tex mesh fixed to the parietal wall by fibrin glue (Tissucol).

We found Hi-tex dual-sided composite mesh to be an excellent material for repairing abdominal defects. As we noted in a pig model **(Figure 1)**, the polyester side allowed perfect implantation into the parietal peritoneum with good fibroblast colonization and rapid tissue fixation. The polyurethane side that is nonabsorbable, nonadherent and smooth, allowed fluid transfers and contact with viscera. With a median follow-up of 20 months, no major complications were observed; no intestinal occlusion or subocclusion, no prosthesis infection and/or migration, and no incisional hernia relapse occurred. In the immediate postoperative period, no patients developed seromas **(Table 2)**, which are a very common finding in incisional hernia repair surgery. This could be explained by the fact that in fixing the mesh with fibrin glue no dissection or cruentation of tissues occurred. Fixing Hi-tex with fibrin glue was feasible and easy when a parietal defect was <6 cm. In these cases, a low-weight mesh of 15cm or 12cm in diameter or even a 15-cm x 20-cm mesh could be used, assuring an overlap of the mesh over the defect of at least 4cm in each direction. The overlap is necessary to avoid incisional hernia relapses. When 12-cm

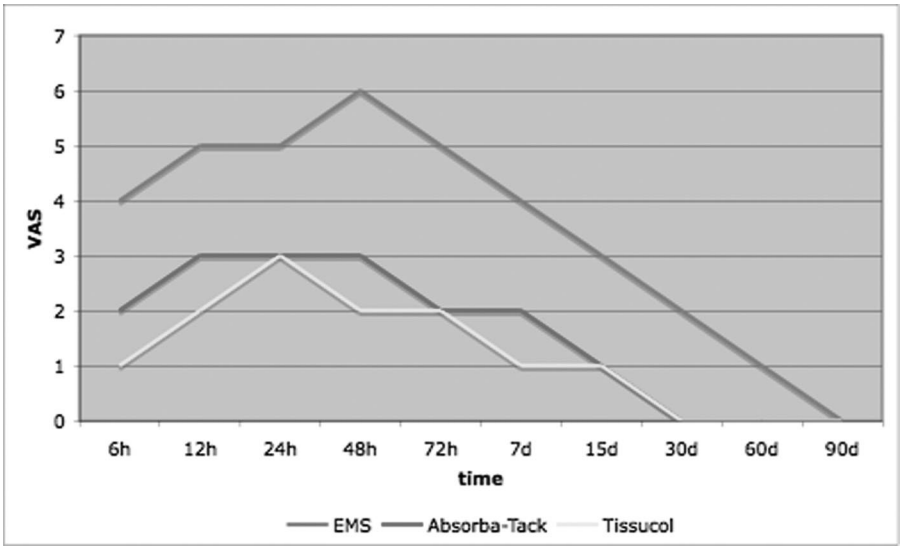

Figure 3. Mean pain scores were ranked according to the Visual Analogue Scale (0 = no pain, to 10 = worst pain) at different times (h = hours, d = days).

or 15-cm round Hi-tex meshes were used, we did not need transperitoneal stitches to temporarily attach the mesh at the parietal peritoneum, because of the good memory and elasticity of the prosthetic material. Tissucol was diluted (see **Materials and Methods**) to give us time to pour it in concentric circles on the prosthesis and then to correctly place the mesh on the abdominal defect.

The combination of Hi-tex and Tissucol resulted also in a short operative time and hospital stay **(Table 2)**. Moreover, we noted very low postoperative pain **(Figure 3)**. Patients ranked the highest pain 24 hours after the intervention with a value of 3 on the Visual Analogue Scale, which has a range of 0 minimum to 10 maximum.

CONCLUSION

Our data show that Hi-tex composite mesh used for laparoscopic incisional hernia repair with fibrin glue as the mechanism of fixation for parietal defects <6cm in diameter at their major axis has very good outcomes for patients, especially postoperatively.

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